III. HISTORY OF PROVIDENCE INDUSTRY

PRE-INDUSTRIAL PERIOD

The topography and location of Providence indirectly affected the city's industrial development by providing a natural protected harbor and neighboring arable countryside for the formation of a trade center; the flourishing shipping economy of the eighteenth century provided an economic base for the city's nineteenth-century industrial development. The physical setting also directly affected industrial development in the types of manufacturing companies which formed in Providence in the nineteenth century. During the pre-Revolutionary period the town gradually shifted from a farming to a shipping community, and various physical features of the town were modified to accommodate this transition. The Revolutionary War accelerated the town's ascendancy to a position of trade center for southern New England; the post-Revolutionary period was an era of prosperity in this trade center from which emerged the beginning of Providence's and the country's industrial revolution.

The late eighteenth century was a formative period for Providence's later industrial development. Providence had gained control of the Rhode Island shipping trade and the economy was flourishing. In this prosperous environment new trades and shops were founded; a few of these shops later became important Providence industries or formed the basis for the development of new industries.

Two important businesses founded in the late eighteenth century were Joseph Congdon's iron shop and Nehemiah Dodge's jeweler's shop. Congdon's iron shop, located near the present intersection of Canal and Steeple Streets, later became one of Providence's major businesses (Congdon and Carpenter Company). Nehemiah Dodge, in discovering a method for making gold plate, was one of the founders of the jewelry industry.

Two events were significant in accelerating industrial growth in Providence and surrounding rural areas. In 1789, the Providence Association of Mechanics and Manufacturers was formed, and in 1790 Slater Mill, the first American machine-powered, cotton-spinning mill, began operations.

In 1789, seventy-nine manufacturers and tradesmen formed the Providence Association of Mechanics and Manufacturers (PAMM), whose stated aims were to encourage industry and to enforce manufacturing standards. This artisan organization represented the first organized effort in Rhode Island (and one of the first in the country) made by manufacturers to confront the problem of a market glutted by goods manufactured in Britain. One of the most important roles of PAMM was in helping to sway public opinion in favor of Rhode Island's ratification of the United States Constitution in 1790. Even before Rhode Island was part of the Union, however, PAMM began to contact manufacturing organizations in Rhode Island towns as well as in numerous towns in other states to encourage them to petition the Congress to raise tariffs on imported manufactured goods. PAMM sent several such petitions to Congress between 1790 and 1815, achieving little success, however, in Congresses dominated by farmers and merchants. It was not until these merchants began investing in manufacturing (especially the textile and textile-related industries) that protective tariffs were passed by the Congress in the early nineteenth century. By the mid-nineteenth century, the role of PAMM had faded to that of essentially a fraternal and benevolent institution.

PAMM demonstrated an early and decisive interest of artisans in manufacturing goods on a par with imported goods. The focal point of investments in manufacturing, however, was the production of cotton yarn and cloth as demonstrated by the following comment in a PAMM report of 1791: "As this (cotton) manufacture is growing in consequence, and engages the attention of gentlemen not immediately concerned in the mechanics arts, we doubt not, it will find advocates." The cotton industry's most able advocate was Moses Brown who had left his brothers' mercantile firm (Nicholas Brown and Company) to pursue the challenge of machine-producing cotton yarn with his son-in-law, William Almy. In England, yarn was machine produced on waterpowered cotton-spinning machinery known as the Arkwright System, but knowledge of this system was closely guarded by the British.

While Almy & Brown's talented mechanics built workable machines (set up in a rented fulling mill in Pawtucket), the product was a very coarse yarn, the sale of which afforded the firm little or no profit.

Moses Brown attempted yarn production in the late 1780s, but met with little success until he joined forces in 1790 with Samuel Slater, an English immigrant who had a vast practical knowledge of the Arkwright System acquired as an apprentice and later as overseer for an English textile manufacturer. Within a year Slater, aided by several skilled mechanics, rebuilt Brown's machines into a workable Arkwright system. Slater and Brown's success transformed textile manufacturing from a cottage-based to a factory-based industry. The new factory-based cotton industry was of national importance in establishing a pattern for the country's industrialization during the nineteenth century. In Providence, the cotton industry initiated an era of enormous diversified industrial expansion.

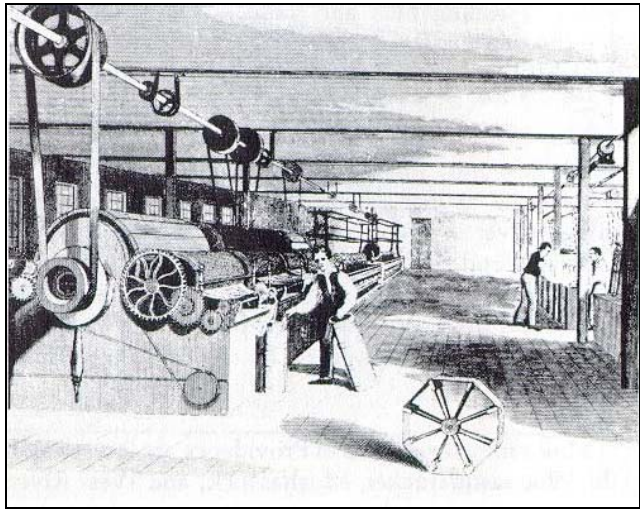

Fig. 3: Idealized view of an early 19th-century spinning mill showing machines used in the Arkwright system; engraving 1891. Courtesy of the Rhode Island Historical Society: RHi X3 479.

EARLY INDUSTRY: 1807-1829

The first thirty years of the nineteenth century was a period of significant physical and economic growth for Providence. Moses Brown and Samuel Slater's success in reproducing an Arkwright spinning system provided a technical advance in textile manufacturing at the end of the eighteenth century. While the invention of the cotton gin in 1793 had the effect of increasing the southern cotton crop tenfold to fifty million pounds a year by 1807 (which lowered the price of cotton significantly), the Embargo Acts of 1807 and the War of 1812 provided the greatest economic incentives for wealthy merchants (unable to carry on normal trade under these conditions) to funnel investments into textile manufacturing. Although these incentives disappeared when trade was resumed at the end of the war, resulting in an inevitable postwar recession in cotton and woolen manufacturing, merchants who had made a significant financial commitment to manufacturing defended their investments with the passage in Congress of the first protective tariffs.

Once textile manufacturing was supported by this small but powerful number of merchants-turned-manufacturers, advances were made in transportation systems (important to both merchants and manufacturers) and power-generating systems vital to manufacturing. While the Blackstone Canal was a major effort at improving the overland system of transportation, it ultimately did little to aid industry in transporting goods; operational problems and cost overruns, as well as the advent of the steam locomotive, caused its abandonment in 1848. The stationary steam engine, on the other hand, had an enormous salutary effect on industrial expansion, and its manufacture became one of Providence's major industries.

Embargo Acts and the War of 1812

While some Providence merchants reacted to the embargo by violating the law and carrying on a lucrative, if dangerous, smuggling operation, and others went bankrupt when their livelihood was severed, merchants who had already accumulated vast profits or who had inherited shipping fortunes were able to invest in non-maritime ventures. One alternative was cotton-yarn manufacturing which, having sparked the Industrial Revolution in England, held the greatest interest for potential American manufacturers. Besides available financial resources and access to water-powered, cotton-spinning technology, investors in cotton mills at this time had two additional advantages—the availability of vast amounts of cheap raw cotton (normally shipped to England) stored in seaport warehouses, and the absence of imported, finished British products on the market. In order to supplant British imported goods, owners of spinning mills either adopted the "putting out" system, delivering yarn to hand weavers operating looms in their homes, or employed hand weavers in mills. Although the strictures of the Embargo Act were lessened several times before 1812, the trade situation remained unstable, and investors continued to finance spinning mills. By 1809, twenty-seven spinning mills were counted in Rhode Island, southern Massachusetts, and eastern Connecticut. Manufacturing investments increased after the outbreak of war in 1812 as prices for finished goods rose and the market expanded to fill wartime demands.

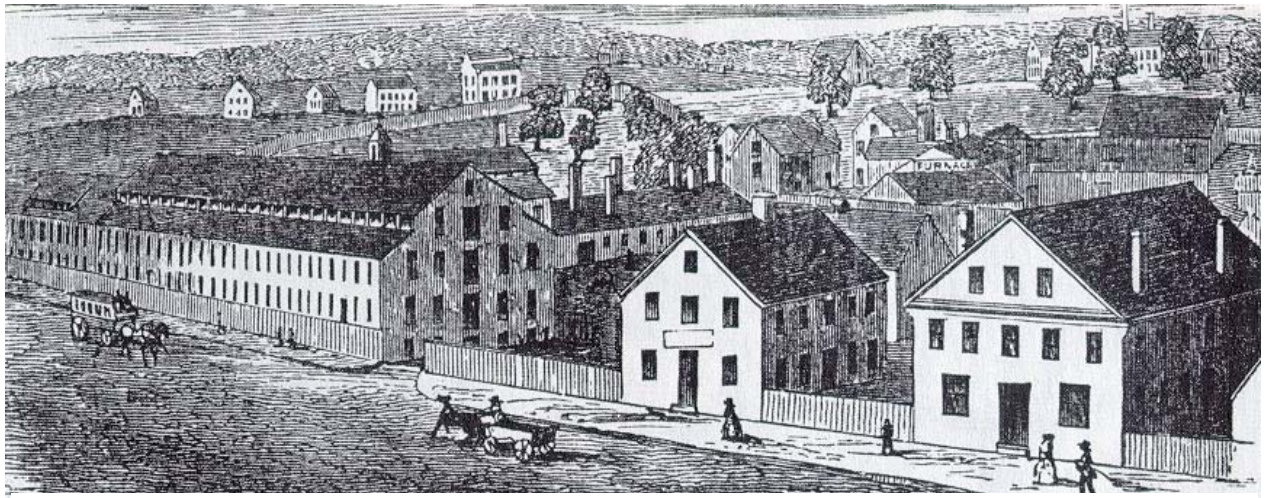

Fig. 4: Franklin Foundry and Machine Company (1800; demolished); Charles Street; engraving, 1860. One of Providence's earliest foundries, by the mid-19th century it was one of the city's most important textile-machine companies. Courtesy of the Rhode Island Historical Society: RHi X3 2850.

Providence merchants, such as the diversified shipping firm of Brown and Ives, invested in cotton-spinning mills in the rural areas of northern and northwestern Rhode Island where cheap and plentiful waterpower was available. One new industrial venture, however, appeared in Providence in 1808 when Thomas Fletcher, a weaver of narrow fabrics (such as tapes, rufflings, and lampwicks), moved his business from Boston to Providence. Until the passage of the Embargo Act, Fletcher had probably imported his cotton yarn from England. With his source of cotton yarn severed, however, Fletcher moved close to the ample supply of cotton yarn produced by Slater Mill in Pawtucket. That Fletcher moved to Providence instead of Pawtucket was indicative of Providence's attraction as a marketing and distribution center. Fletcher's narrow-fabric business formed the basis for the Fletcher Manufacturing Company (47 Charles Street), one of Providence's largest manufacturing companies by the late nineteenth century.

The embargo and the subsequent war similarly encouraged the development of the woolen industry previously inhibited by the importation of goods manufactured in England. Merino sheep had been imported from Spain as early as 1803 by David Humphreys, but the demand for Merino wool—a finer wool than common domestic sheep's wool—increased dramatically after the embargo. A "Merino mania" resulted in a sharp rise in the price of Merino wool to four times the cost of common wool by 1809 and, after the embargo as modified, a massive importation of Merino sheep from Spain (about 2500 between 1809 and 1811). This "Merino mania" manifested itself in Providence when John Waterman founded the Merino Mills in 1812.

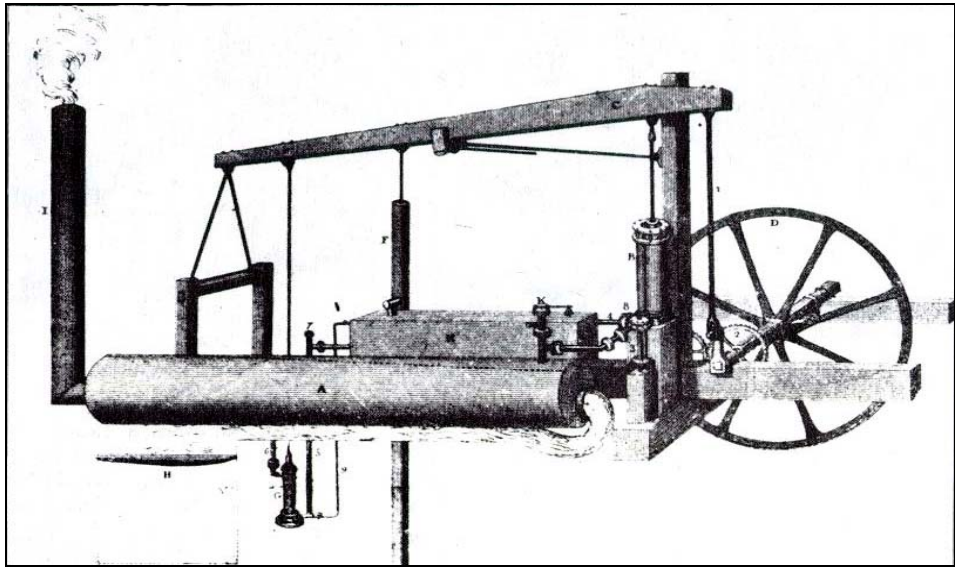

Fig. 5: Columbian Steam Engine (1814); engraving, 1901.
Courtesy of the Rhode Island Historical Society: RHi X3 2835.

The turn of peacetime trade, however, brought all grades of English-produced woolens back into the American market, and, soon after the end of the war, Waterman transformed the mill to a cotton mill.

While Waterman's Merino Mill represented a relational investment in woolen manufacturing, the Providence Woolen Company, founded at the same time, characterized a large-scale corporate venture in woolen production. Financed by prominent Rhode Island merchants, with backing from the Providence Association of Merchants and Manufacturers, the Providence Woolen Company was founded in 1812 to produce broadcloth. This company was one of the first Rhode Island companies to supplement waterpower with an Evans steam engine and was one of the state's first integrated textile mills. The Providence Woolen Company works (now the site of the Allen Printworks Complex, Dryden Lane) was the largest woolen mill in the country at the time. Yet, like many textile mills, this company failed at the end of the war when British woolen goods were dumped on the American market. It was many years before Providence investors again viewed woolen manufacturing as a lucrative investment.

The textile-finishing industry, though it attracted fewer investors at this early stage, proved more stable than the volatile woolen industry. Henry Hoppin, another successful Providence merchant, was one of the founders of the Patent Calender Company, formed in 1814. This company, originally located on Sabin Street, specialized in textile finishing by the calendering process; it was the first finishing company to use a calender with differential gears and the second Rhode Island firm to use the Columbian Steam Engine, built by Oliver Evans. The Patent Calender Company, which later was run by the Hoppin, Olney, and Dyer families under the name of the Providence Dyeing, Bleaching, and Calendering Company, remained in Providence for more than one hundred and twenty years.

Another venture which flourished during the war and provided the basis for further industrial development in Providence was the Franklin Foundry, founded in 1800 by Stanford Newell, Isaac Thurbers, and others. During the war the Franklin Foundry produced cannon. Later known as the Franklin Machine Company, it became one of Providence's largest textile-machinery manufacturers.

By the end of the war with England, many Providence entrepreneurs had made financial commitments to manufacturing, whether in mills located in Providence, Pawtucket, or in the rural hinterland. In one sense, the few early textile companies (especially those of the Providence Woolen Company and the Patent Calender Company) had set a pattern for later industrial development by seeking a high degree of sophistication in machine technology. This phenomenon cannot be attributed entirely to the wealth of Providence investors, since many funneled money into mills in rural Rhode Island. Another explanation is the large investment made in the purchase of Providence land which demanded an equally high return. A manufacturer near the center of Providence paid a premium for land because of its proximity to brokerage houses which both sold raw materials to the mills and marketed finished goods. Having invested a greater amount of money in the purchase of land, these entrepreneurs procured skilled managers and sophisticated machinery to ensure higher profits. The preciousness of land in Providence and, of course, the wealth of Providence businessmen were among factors which ensured high degree of technological sophistication in the Providence textile and base-metal industries later in the nineteenth century.

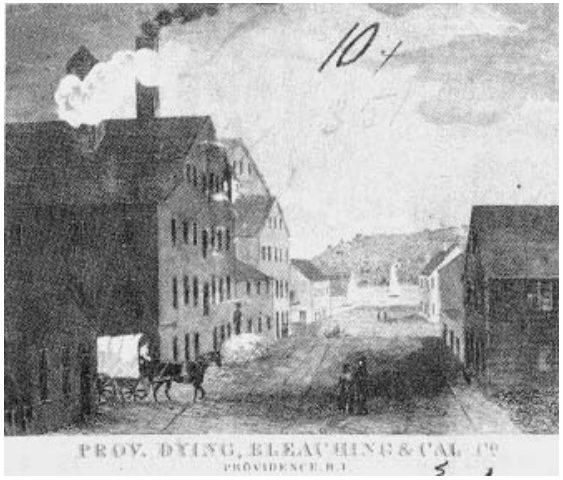

Fig. 6: Textiles label (c. 1845).

Protective Tariffs

Overseas trade once again flourished for a short time at the war's end in 1815, and manufacturers consequently faced serious economic setbacks. The American market was flooded with British cotton and woolen goods and many American manufacturers were faced with yard overstocks, resulting in bankruptcy for numerous companies.

By this time, however, many influential citizens had invested a sizable amount of money in textile production and they acted to save their investments. These entrepreneurs turned to the legislative process to overcome the economic hardships produced by foreign competition. As a result, the first protective tariff was passed in 1816, imposing duties on imported textile goods. Tariffs have continued since the early nineteenth century as a fundamental element in the industrial economy.

The Power Loom

The introduction of the Gilmour power loom to Rhode Island in 1817 helped to integrate and stabilize the textile industry. By enabling weavers to keep pace with spinners, the power loom diminished the problem of yarn overstocks, although an ever fluctuating and unregulated market continued to result in periodic overstocks in the textile industry. The promoter of the Gilmour Loom, Daniel Lyman, in a gesture that helped to advance the Rhode Island cotton industry, refused a patent, and copies of the loom soon appeared in many neighboring cotton mills, although a power loom for fancy weaving was not developed until the mid-nineteenth century.

Steam Power and Early Steam-Engine Manufacturers

While water continued to power machinery in many textile mills throughout the existence of the New England textile industry, it had several drawbacks. As more manufacturers located their mills next to rivers and built dams and power canals, conflicts over water rights developed. Moreover, when summer droughts decreased the rivers' water level there was not sufficient force to run the machinery. However, too much water from spring flooding was also a problem. The water wheel could not function smoothly in backwater and could not turn at all in extremely high water. The winter presented another problem for water-powered mills because the wheel frequently froze in place. These factors eventually posed less of a problem as waterpower technology became more sophisticated, but for most areas in Providence (with the exception of the western section) the available waterpower was sufficient to power only the smallest operations. Thus water from the Woonasquatucket in the more rural western part of Providence (actually part of Johnston until 1898) continued to power mills well into the twentieth century, but urban mills were better suited to steam power.

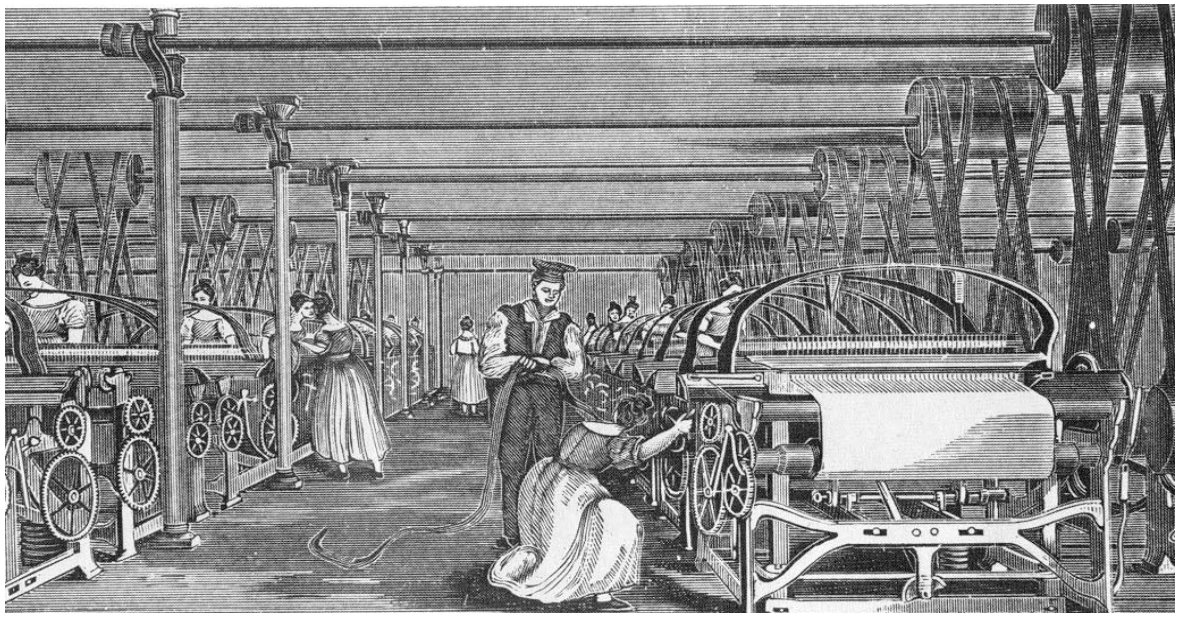

Fig. 7; Power-Loom Weaving in the early 19th century; engraving, 1891. Courtesy of the Rhode Island Historical Society: RHi X3 2843.

During the 1820s and 1830s, the use of marine steam engines (powering passenger and freight boats) and stationary steam engines (powering machinery), which had been largely experimental until about 1820, became more widely accepted. Steam power had an enormous effect on Providence's commercial and industrial development during this period.

The earliest known manufacturer of steam engines in Providence was John Babcock, who had a shop on South Main Street in the 1820s. Babcock's son, John Babcock, Jr., and Robert L. Thurston formed a steam-engine company in 1830 which later evolved into the Providence Steam Engine Company (521 South Main Street).

Possibly using one of Babcock's engines, Samuel Slater built a cotton mill on the land-locked site at Ship and Dyer Streets in 1827. Known as the Steam Cotton Mill, this was the first mill in Providence, and probably in Rhode Island, to use a steam engine as its sole source of power. The success of this venture encouraged other manufacturers to build steam cotton mills in the 1830s.

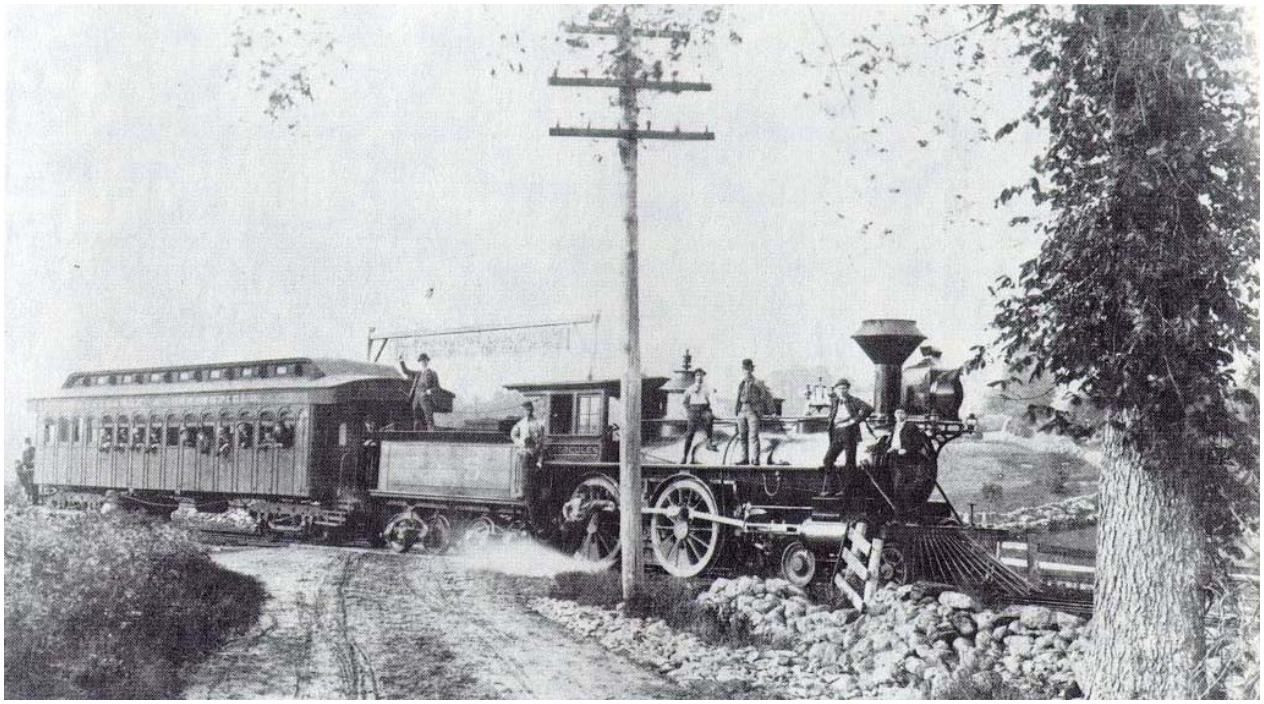

Fig. 8: Steam Locomotive of the Providence and Springfield Railroad; photograph, c.1873. Courtesy of the Rhode Island Historical Society: RHi X3 2262.

EARLY INDUSTRY: 1829-1848

The period from 1829 to 1848 was characterized by economic stabilization as well as industrial and geographic expansion. The depressions caused by the panics of 1829 and 1837 motivated the surviving companies toward economic stabilization through consolidation of financial resources. Thus textile companies gradually became larger, employed more workers, and had a greater amount of financial backing. Another step towards stabilization was manifested in attempts to standardize mill construction, promoted by Zachariah Allen's founding of the first factory-mutual-fire-insurance company—the Manufacturers Mutual Fire Insurance Company of Providence (1835), which provided financial incentives for manufacturers who installed fire-fighting equipment in their mills and employed fire-inhibiting methods of construction. The expansion movement, presaged by the completion of the Boston to Providence Railroad in 1835, was evidenced by the increasing diversity of textile mills, the founding of the base-metal industry, the strengthening of the steam-engine industry, and the growth of the jewelry and silverware industry.

The population of Providence grew from nearly 17,000 in 1830 to over 23,000 in 1840 and leapt to over 40,000 in 1848—largely due to Irish immigration in the 1830s.

The benefit of a huge labor force was not fully apparent in Providence's industrial expansion until the 1850s—with the exception of railroad expansion during the 1830s and 1840s, made possible, to a large extent, by immigrant labor.

Steam Power

The growth and expansion of the steam railway system between 1830 and 1850 was a crucial factor in making Providence one of New England's most important industrial cities. In 1835, the railroad between Providence and Boston was completed and regular service was initiated. During the next thirteen years, the Providence and Stonington Line (1837); the Providence and Worcester line (1848); and the New York, Providence and Worcester Line (1848) were completed. The culmination of the initial boom in railroad construction in Providence was the enclosure of the cove, the subsequent construction of tracks around the southern and eastern borders of the cove, and the erection of a passenger station at Exchange Place by the Providence and Worcester Railroad in 1848. The impressive railroad station, designed by Thomas Tefft (replaced by the present Union Station of 1898), was appropriately called Union Station since all lines converged at this location in the center of the city.

The railroad's importance to Providence was closely tied to the development of the stationary and marine steam engine. The stationary steam engine allowed manufacturers more flexibility by eliminating the necessity for a river location (although some textile operations such as printing, dyeing, and bleaching were water dependent). The steamship and the steam locomotive transported raw materials such as coal (for steam-engine fuel), cotton, and iron to Providence manufacturers and shipped out finished goods from Providence and neighboring factories to markets in the North, South, and West. But Providence, like other harbor cities, had the advantage of competitive modes of transportation (although during the first railroad boom steamship patronage shrank considerably, it was revitalized during the second half of the nineteenth century) which kept the prices of shipping moderate until the turn of the century when the powerful New Haven Railroad Corporation owned or controlled virtually every mode of freight and passenger transportation in Providence and many other New England cities.

One of the first manufacturers to make use of the benefits of both the stationary steam engine and the steam locomotive was John Waterman who had built the Merino Mills in 1812. Like Samuel Slater's Providence Steam Cotton Mill (1827), the Eagle Steam Cotton Mills built by John Waterman in the mid-1830s depended on steam for its source of power.

Waterman, however, was quick to realize the benefits of being on a railroad line and located his mills on Dike Street next to the tracks of the Providence and Stonington Railroad, then under construction.

The Corliss Steam Engine

In 1845, George Corliss came to the city of Providence because of its reputation as a center for steam-engine manufacturing. While employed at Fairbanks, Bancroft and Company, Corliss began to work on his own to refine steam-engine technology and in 1848 patented an automatic cutoff valve that dramatically increased the efficiency of stationary steam engines. Corliss put Providence at the forefront of American steam-engine manufacture and accelerated the adoption of steam power in Providence industries. One of the first to use one of Corliss' innovative engines was the Providence Bleaching, Dyeing, and Calendering Company (Valley Street) in 1849. This company—under its former name, the Patent Calender Company—had been one of the first to use the Evans Steam Engine in 1814.

Textile Printing and Other Water-Dependent Industries

While steam cotton mills such as Samuel Slater and John Waterman's could be located at land-locked sites, some textile manufacturers such as printing, dyeing, and bleaching companies needed vast amounts of clean water for their operations. Woolen manufacturers also needed water (if they bought raw wool) to wash the dirt and grease out of the fiber. Manufacturers of coarse woolen fabrics could buy pre-washed wool (which when compressed for shipping caused the fibers to break) since they did not need long fibers; but when fine wool and worsted manufacture became one of Providence's important industries later in the century, water for wool washing became a necessity. Moreover, the by-product of these operations was dye- or grease-polluted water which was returned to the stream (a practice which continued well into the twentieth century). Thus, streams and rivers were vital to these sectors of the textile industry both as a resource and a disposal site. Among major Providence companies dependent on water for printing, dyeing, bleaching, or cleaning in the first half of the nineteenth century were the Dyerville Manufacturing Company, a print-cloth manufacturer on the Woonasquatucket River at Manton Avenue (this company also used the river for generating power), and the Allen Printworks on the Moshassuck River at Dryden Lane.

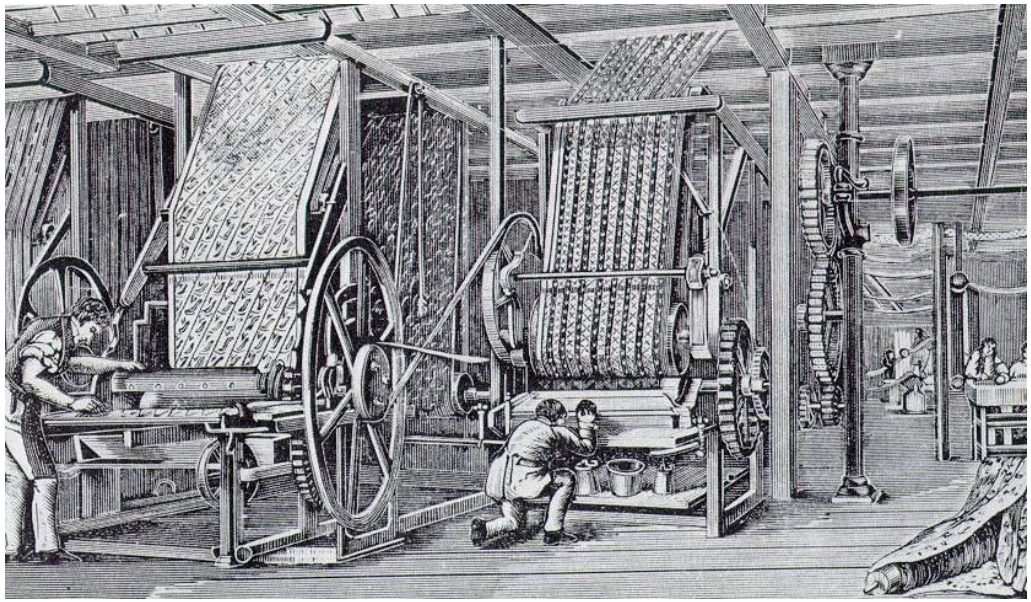

Fig. 9: Calico printing in the early 19th century: engraving, 1891. Courtesy of the Rhode Island Historical Society: RHi X3 2844.

Base-Metal Industries

Although the development of base-metal industries—that is the manufacture of products made from iron or other base-metal materials–can be viewed as a direct response to the blossoming textile industry (since most base-metal products directly or indirectly augmented the manufacture of textiles), not all textile-manufacturing towns and cities developed these industries. Providence already had a few well-established foundries, formed during the era of maritime trade. Men trained in founding or in other trades requiring engineering skills (such as house, mill, or ship building) were oriented toward the engineering challenges of industrial development and because Providence was a wealthy town, investors in new and promising industries were not difficult to find.

One investor in the base-metal industry was the renowned textile manufacturer Samuel Slater who with Thomas Hill founded the Providence Machine Company (1838)—an outgrowth of the machine shop at Slater's Providence Steam Cotton Mill on Dyer Street. This company was among the first to produce sophisticated American spinning machinery. Another major textile machine company was the Phenix Iron Foundry (1830; at Eddy Street, later at Elm Street) which produced the earliest American textile-printing machines.

While machine companies and steam-engine manufacturers evolved in support of the textile industry, other base-metal manufacturers supplied machine parts or tools for the textile machine industry and the steam engine industry, the most important of which was David Brown & Son which later became Brown & Sharpe. This company was established by David Brown, a jeweler and watch and clock maker, and his son Joseph, who had additional training in the machine shop of a cotton mill; David Brown & Son began manufacturing lathes and small tools for mechanics and machinists in the 1840s. While Joseph Brown's tools were instrumental in

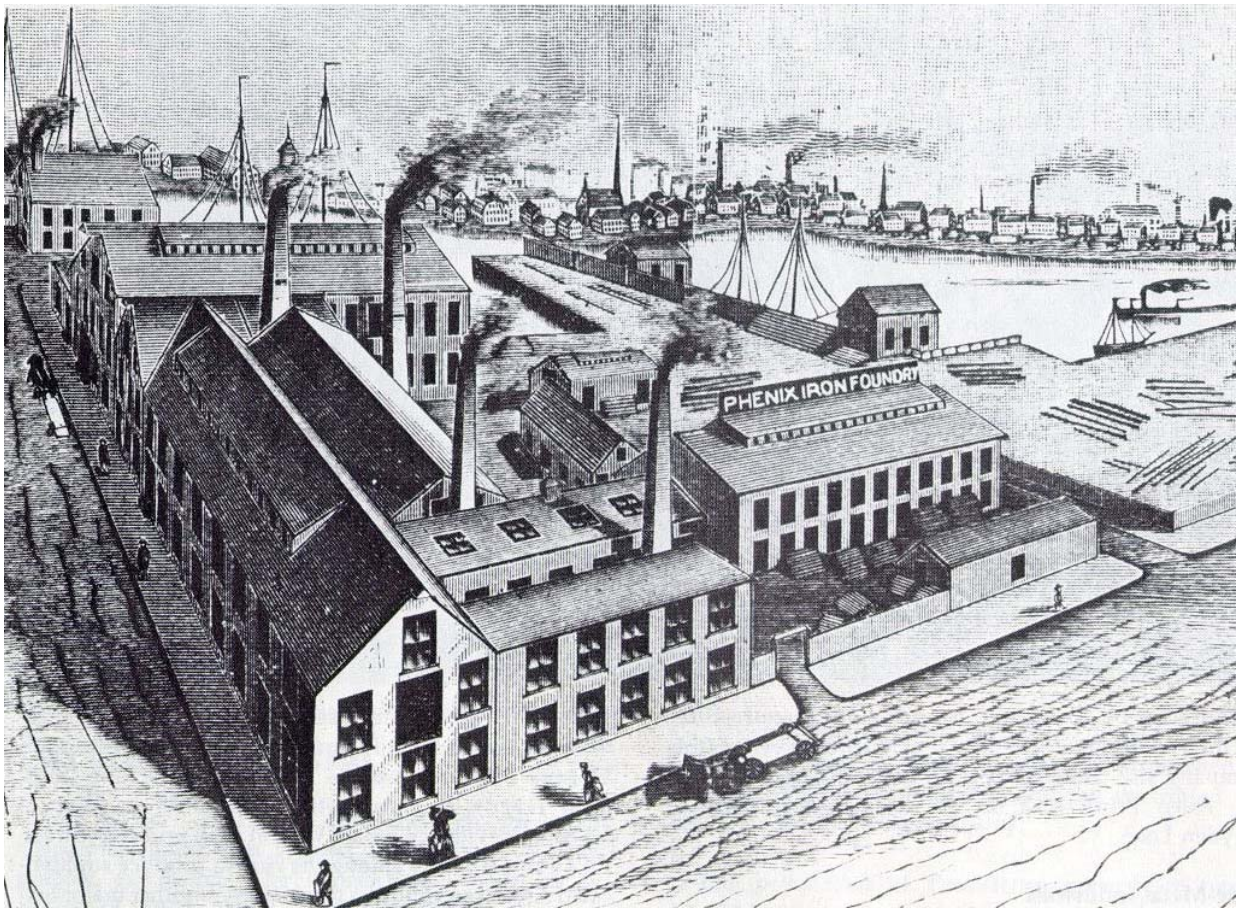

Fig. 10: Phenix Iron Foundry, now the site of the Narragansett Electric Company Power Station (1830 and later); 342 Eddy Street; engraving, 1891.
Courtesy of the Rhode Island Historical Society: RHi X3 2838.

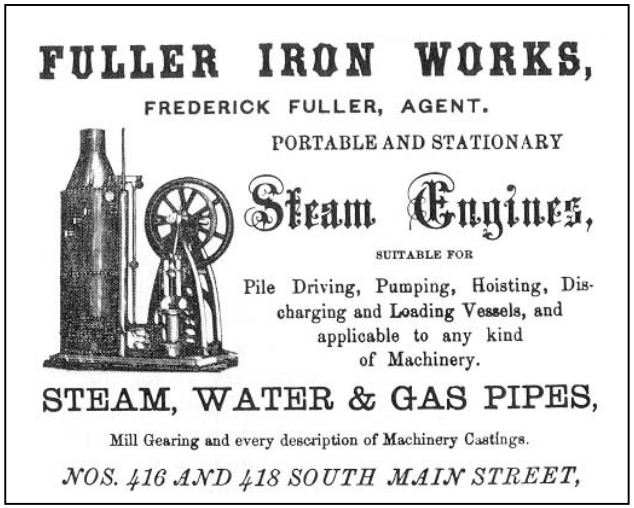

Fig. 11: Advertisement, 1873.
Courtesy of the Rhode Island Historical Society: RHi X3 2864.

increasing textile machine efficiency, it was not long before the same equipment was adapted for use by steam-engine builders and other machinists. The universality of Joseph Brown's (and later Brown & Sharpe's) hand and machine tools ensured the firm's endurance in the twentieth century when the textile industry and the over specialized textile machine industry declined sharply.

Some base-metal industries however were the result of the wave of prosperity and expansion that accompanied American industrialization. As industries expanded and the population swelled, the consequent boom in transportation and construction stimulated the development of the hardware industry. Taking advantage of the expanding market for nails and screws were the Eagle Screw Company (1840) and the New England Screw Company (1850) which later merged into the American Screw Company (Hewes Street), the largest screw manufacturer in the country.

With the boom in house construction also came innovations in such vital functions as heat production. Although the theory of stoves as a separate heating element from the fireplace date from the late eighteenth century, mass production of cast-iron stoves increased considerably as cast-iron technology improved in the 1830s and 1840s. One of the many manufacturers to undertake stove production was Amos Barstow, proprietor of the City Furnace, who in 1836 founded the Barstow Stove Company (Point Street), but, unlike many of the small companies founded at this time, the Barstow Stove Company continued to build innovative models of wood and coal stoves and, later, furnaces into the late nineteenth century.

The period from 1830 to 1850 was a formative period for several other base-metal companies such as the Fuller Iron Foundry (25 Pike Street), the Providence Tool Company (148 West River Street), and the New England Butt Company (304 Pearl Street), which all achieved prominence in the late nineteenth century.

The Jewelry and Silverware Industry

The Providence jewelry and silverware industry grew steadily, if not rapidly, from twenty-seven firms, employing 280 workers in 1830, to fifty-seven firms, employing 590 workers in 1850. While the jewelry industry generally retained the same partnership structure in 1850 as twenty years earlier, the silverware industry shifted towards a larger scale, corporate structure. Though the jewelry and silverware industries have always been associated as manufacturers of precious-metal products, the growth patterns of these two industries diverged after 1842.

Unlike the textile and base-metal industries, the manufacture of jewelry required scant equipment since most work was done by hand. Consequently, it required comparatively little to capitalize a jewelry company. The cost of producing jewelry had been cut in the late eighteenth century with Nehemiah Dodge's discovery that gold could be rolled on copper to make a cheaper grade of jewelry. The lamination of gold onto a cheaper metal was further refined when Thomas Lowe, an English jeweler, came to Providence with a new process of sweating a sheet of gold onto another metal surface to produce a gold-plated substance. That Lowe chose Providence as the city most likely to provide opportunities for his skills and knowledge was an indication of the city's growing reputation as a jewelry center. Providence's importance in this field was due to the existence of a strong core of jewelers during the maritime era; the trade continued to expand under the apprenticeship-journeyman system, whereby after seven years' apprenticeship, two or more journeymen often combined resources to form a partnership. Usually, one partner managed the shop while the other took charge of the clerical work and the marketing of the product.

The other vital factor in Providence's growth as a jewelry center was the establishment of non-local markets. Even before 1830, markets were created in Boston; with the advent of the railroad, however, they were established in New York, as well as cities of the South and West. While the industry continued to develop and expand its markets during the first half of the nineteenth century, it was not until the late nineteenth century that it attained a mechanized and corporate structure.

Unlike the jewelry industry, the Providence silverware industry was not established until the 1830s when the Boston silversmith Henry L. Webster convinced Jabez Gorham, a Providence jeweler, that there was a large market for silver flatware and holloware. The industry grew from a small silversmith shop under the direction of Gorham and Webster to a thriving, mechanized industry and corporate enterprise after the business was taken over by Jabez Gorham's son John in 1842.

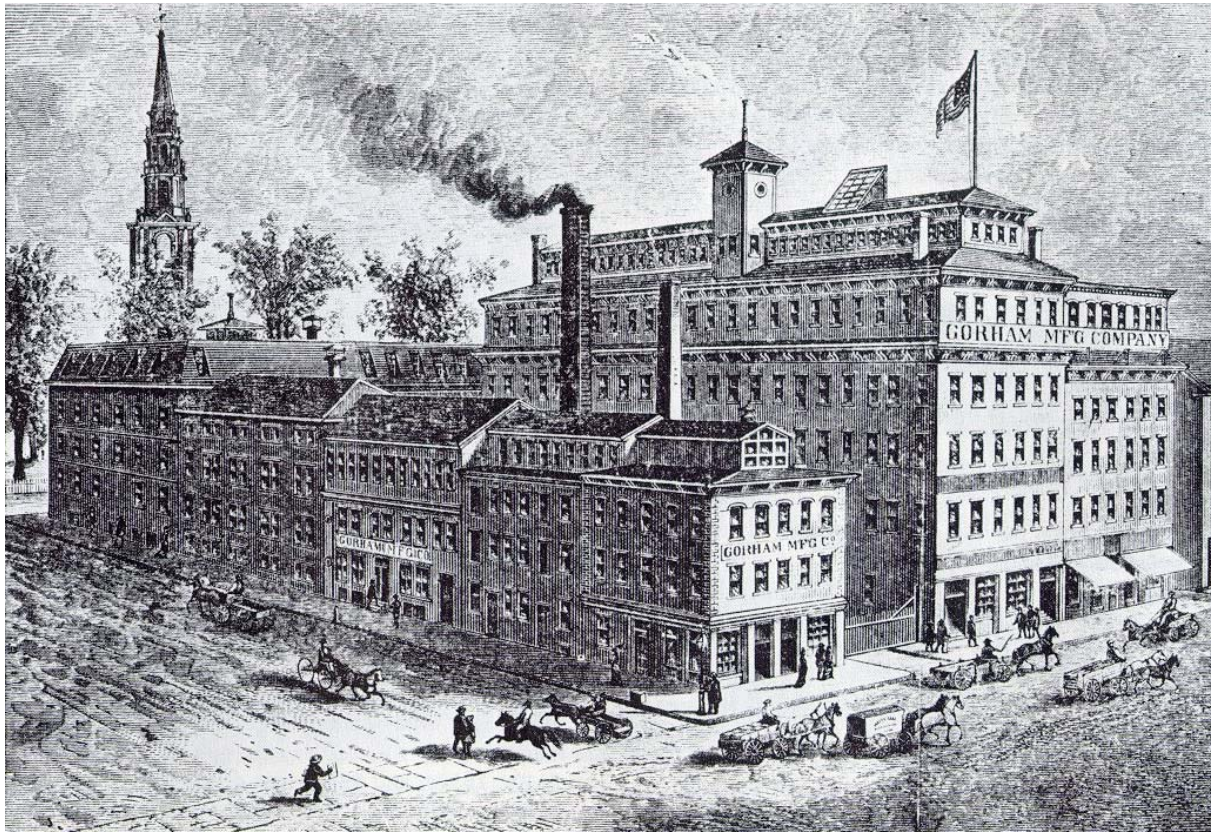

Fig.12: Gorham Manufacturing Company, now the site of the Providence-Washington Insurance Company Block; Steeple Street: engraving, 1886. Courtesy of the Rhode Island Historical Society: RHi X3 2841.

INDUSTRIAL EXPANSION: 1850-1860

Between 1850 and 1860, the population of Providence grew from approximately 40,000 to 50,000 due to vast numbers of Irish immigrants. Immigration—which resulted in a greatly expanded labor force—and the coincident development of "automatic" textile machinery—such as the cap spinner which could be operated by unskilled or child labor—were the major forces in the expansion of the textile industry.

Between 1850 and 1860, the number of cotton mills grew from eight with 1,138 workers to fifteen with 1,730 workers, and the number of woolen mills had grown from two with 60 workers to four with 382 workers. Though the Providence textile industry was expanding and increasing in technological and administrative sophistication by 1860, Providence manufacturers were in general overshadowed by the larger operations of rural Rhode Island.

Some Providence textile companies began to change. in size from relatively small companies employing between 50 and 150 workers to larger companies employing over 200 workers. This trend was more apparent in the Providence printing and finishing industries than in the city's spinning and weaving mills. Another development during these years was a gradual transition from the jointly owned company to the corporation—a transition which was made much later in Rhode Island than other manufacturing states because of a consistently conservative legislature.

The expansion of the Rhode Island textile industry triggered an unparalleled surge of growth in the base-metal industries, ranging in products from steam engines and textile machinery to stoves and sewing machines. In Providence, the industry quadrupled in size from twenty-five firms employing 2,022 workers in 1850 to ninety-four companies employing 3,131 workers in 1860. Moreover, Providence, always strong in the base-metal industries, entirely overshadowed the once booming iron-working center of Pawtucket with almost four times the number of companies. By the eve of the Civil War, then, Providence had an expanding and continually diversifying base-metal industry while those of Pawtucket, though well established, remained fairly static after 1850.

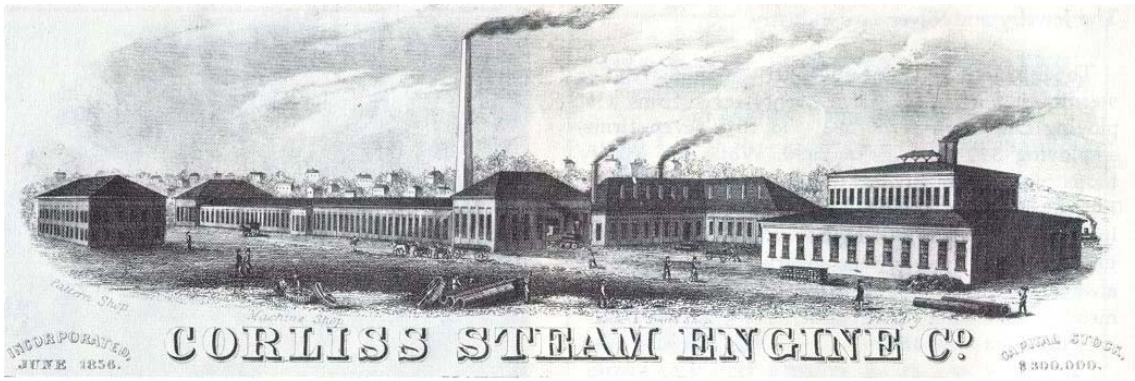

Fig. 13: Corliss Steam Engine Co. (c. 1857; buildings now altered); 14 West River Street; photograph c. 1857. Designed by George H. Corliss. Courtesy of the Rhode Island Historical Society: RHi X3 2854.

Immigration, Incorporation and Expansion

While in the 1820s and 1830s the population of Providence was augmented by small numbers of skilled English and Scottish workers, the population boom of the 1840s, 1850s, and 1860s was due largely to the arrival of large numbers of Irish immigrants. The failure of the potato crop in 1846 and chronic political repression were strong motivating factors for Irish emigration. Furthermore, manufacturers sought a large, flexible, and unskilled labor force to augment and partially replace the skilled independent Scottish, English, or Yankee worker. Irish immigrants were crucial to Providence's industrial expansion, but social prejudice and a decreasing need for skilled labor in the textile industry precluded much improvement of their socio-economic status until the end of the nineteenth century when second-generation Irish began to rise in the hierarchy of industrial Providence.

By the 1850s, the influx of Irish immigrants had solved most of the labor-supply problems of mill owners. Industry was clearly ready for expansion, but large ventures required large capital investments—which, under the joint-ownership structure, were difficult to acquire and manage. In 1847, under pressure from manufacturers, the Rhode Island legislature finally liberalized corporate privileges for manufacturing corporations by allowing larger stock sales and limiting corporate liability. One advantage of the new law was that corporations could acquire large amour of capital by selling stock while avoiding an unwieldy management system (a problem with joint-ownership companies). Moreover, the failure of the corporation under the legislation act eliminated the personal liability of the individual stockholder–an important concession to investors in manufacturing corporation since the threat of bankruptcy was ever present in the fluctuating industrial economy.

The rate of incorporations increased significantly after the new provisions became law. While seven companies petitioned for, and were granted, charters in the 1840s, twenty-seven Rhode Island companies were chartered in the 1850s. Two major Providence companies which took advantage of the new corporation law during the 1850s were the Atlantic Delaine Company (1851) and the Corliss Steam Engine Company (1856, The Panic of 1857 and the subsequent bankruptcies of numerous companies (one of the major ones in Providence was that of Phillip Allen and Sons at Dryden Lane) convinced many manufacturers that the corporate structure was financially more prudent than the joint-ownership form.

New Industries

At the same time that many textile companies were expanding in the period before the Civil War, entirely new types of base-metal companies were forming in Providence; among them were Stillman White's Brass Foundry, which was known for its Anti-Friction Lining Metal (used by steam-engine manufacturers and other types of precision-machine companies for lining bearings), and the John & Thomas Hope Company, known for the pantograph engraver (the purpose of which was to transfer and engrave a pattern onto the copper rollers used for printing cloth) which eliminated the need for an artisan.

Two Providence companies already in operation—Brown & Sharpe and the Providence Tool Company—directly benefited from the development of the sewing machine in the mid-nineteenth century. In 1858, five years after Lucien Sharpe had joined Joseph Brown's small company, the firm of Brown & Sharpe procured a contract to produce the Willcox and Gibbs Sewing Machine. At about the same time, the Providence Tool Company obtained a contract to produce the Household Sewing Machine.

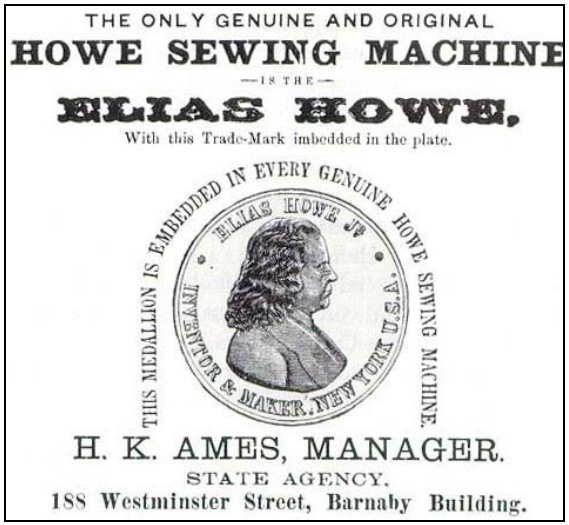

Fig. 14 Advertisement for the Howe Sewing Machine; illustration, 1872. Elias Howe perfected and patented the first double-thread sewing machine. Courtesy of the Rhode Island Historical Society: RHi X3 2863.

Fig. 15: First Rhode Island regiment leaving Exchange Place (1861). The Civil War had a major salutary effect on the textile and base-metal industries in Providence. Courtesy of the Rhode Island Historical Society: RHi X3 1692.

This mass production necessitated the development of small precision-component construction. Joseph Brown of Brown & Sharpe and Frederick Howe of the Providence Tool Company produced the necessary precision gauges and machine tools. These tools were of vital importance as the principles of interchangeable parts became the basis for machine production in the nineteenth century.

INDUSTRIAL EXPANSION: 1860-1873

Between 1860 and 1873, two events—the Civil War and the Panic of 1873—critically affected Providence industry. The outbreak of the Civil War—coming after a decade of mill expansions, capital growth, and new industrial development—provided maximum profits to established manufacturers, which, in Providence, were mainly the base-metal industries, since they could quickly step-up production or adapt machinery to meet wartime needs. At the same time, however, the war provided needed incentives for the rapid expansion and mechanization of industries (especially the woolen and worsted industry) which had developed at a slower pace before 1860. New developments during or after the war—such as the construction of the streetcar network, the erection of a large new coal-gas production plant, the growth of Wanskuck Village, and the first efforts at labor organization (the Olneyville Ten Hour Association of 1873)—were indications of a prospering industrial economy which lasted until the Panic of 1873. The subsequent depression caused a sharp drop in Providence's industrial production. Prosperity did not fully return to Providence industries until 1879.

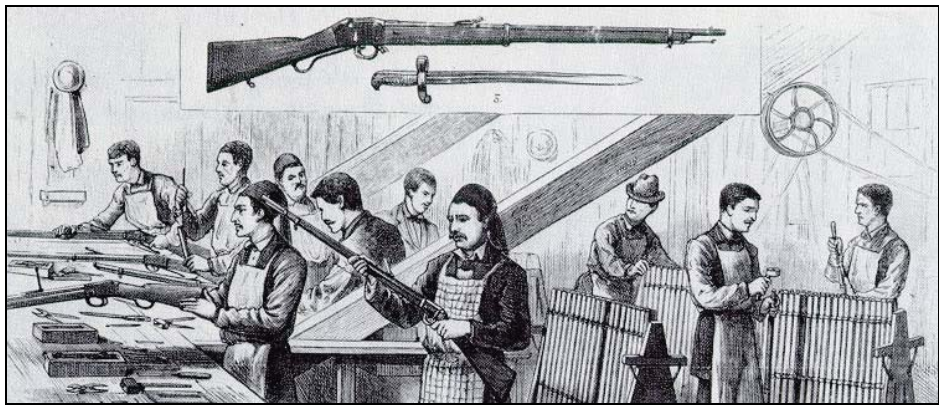

Fig. 16: Turkish Officers inspecting guns at the Providence Tool Company; illustration, 1877. Courtesy of the Rhode Island Historical Society: RHi X3 2867.

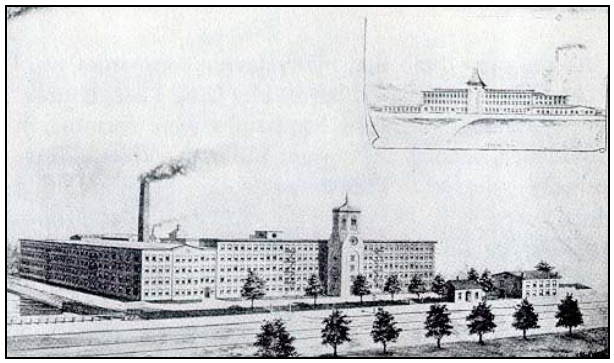

Fig. 17: Wanskuck Village of the Wanskuck Company: lithography, 1922

Weapons Manufacture

The Civil War triggered a full scale expansion of existing industries and a proliferation of new manufacturing companies. Weapons and uniforms were in sudden demand as were machines and steam engines necessary to produce these items.

Companies formed to manufacture arms included the Burnside Rifle Works, manufacturers of breech-loading rifles, and Nicholson & Brownell, manufacturers of parts for Springfield muskets. Companies which adapted their machinery to produce weapons were the Builder's Iron Foundry (Codding Street) and the Providence Tool Company (148 West River Street).

At the end of the war, however, most of these companies either resumed production of their peacetime line or developed new lines of products expected to prove lucrative. The Providence Tool Company reinstituted the manufacture of sewing machines but continued to manufacture rifles (and were, in fact, the major supplier to Turkey during the Turko-Russian War of the 1870s). William Nicholson (of Nicholson & Brownell) sold all of his gun-manufacturing interests and formed the Nicholson File Company, the first successful machine-made, file-manufacturing company in the United States. By the turn-of-the-century, the Nicholson File Company was one of Providence's major industries. The stockholders of the Burnside Rifle Works also reorganized at the end of the war. The new firm, called the Rhode Island Locomotive Works, became one of the nation's largest producers of steam locomotives.

The Woolen and Worsted Industry

Although the Valley Worsted Mill had been manufacturing worsted yarn since 1842, and the Elm Street Woolen Company (later the site of the Vesta Knitting Mills, Imperial Place) had been manufacturing coarse woolens since the 1840s, the woolen and worsted industries did not flourish in Providence until the 1860s.

Because the wartime blockade of Southern ports severed the supply of cotton, many mill owners (especially the smaller operations with small stocks of cotton) were forced to close. There was, however, no shortage of wool. Domestically grown sheep provided inexpensive wool; importation supplied additional varieties, although tariffs made this wool more expensive. Short-fiber wool was used in the production of both coarse and fine goods, the end product depending on both the quality of the raw material and the cleaning, carding, spinning, and weaving processes.

Long-fiber wool, usually of a medium grade, was used to make worsted yarn which produced a fine and durable cloth. The combing process used to make worsted goods had been a manual operation until the 1850s when the Lister and Noble automatic combs were introduced in England. This new technology plus the availability of cheap, long, staple (fiber) wool through the Reciprocity Treaty with Canada (1854-1865) stimulated the growth of the worsted industry, although the boom in worsted production did not occur until the 1870s and 1880s when the cloth gained widespread popularity.

The first of several large woolen mills built in Providence during or immediately after the Civil War was the Riverside Mills (Aleppo Street), built in 1862 by George W. Chapin and Lewis T. Downes to produce mohair and astrackhan cloth used for fine coats Chapin and Downes modeled their operation on European woolen factories and installed the latest European machinery into their factory.

Soon after the construction of the Riverside Mills, Jesse Metcalf and Henry Steere, who had both been active in the textile industry, built a large woolen mill, the Wanskuck Mill, on Branch Avenue. Two years later, the Wanskuck Company made its first shipment of fine woolen goods to New York. Other mills to begin the manufacture of fine woolen goods during or after the war were the Atlantic Delaine Company, which built a large mill next to their delaine factory, and the Weybosset Mills, bought by Royal C. Taft and William Weeden in 1863 and soon converted to the production of cassimeres. Towards the end of the war, Chapin and Downes began manufacturing worsted goods which were among the first

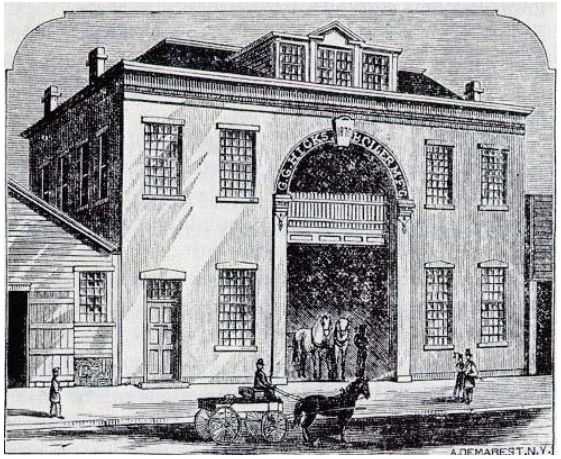

Fig. 18: Hicks Boiler Works (1870, relocated 1920); 614 South Main street; engraving, 1875. A small base-metal operation which manufactured and repaired boilers until the mid-1970s. Courtesy of the Rhode Island Historical Society: RHi X3 2851.

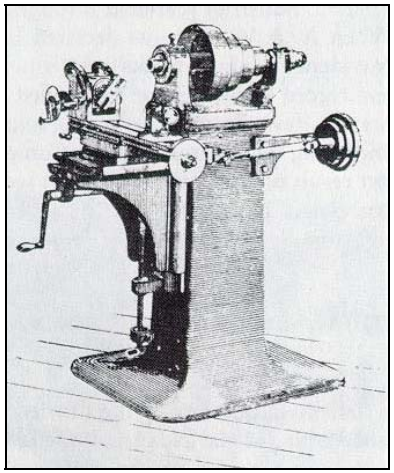

Fig. 19: The Universal Milling machines; patented by Joseph Brown in 1865. This machine was a major breakthrough in the production of interchangeable parts. Courtesy of the Rhode Island Historical Society: RHi X3 2852.

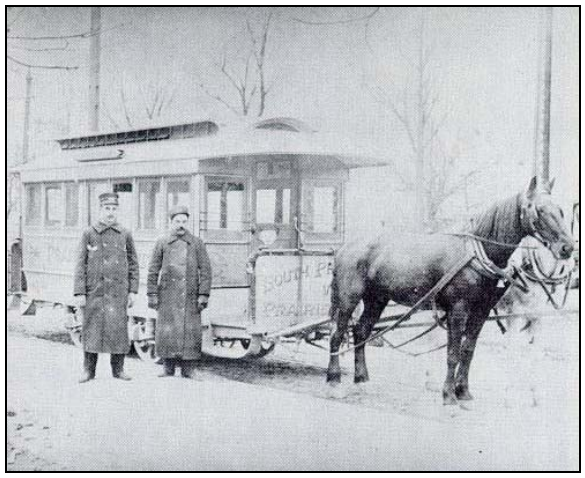

Fig. 20: Horsecar on Prairie Avenue; photograph, c. 1880.

high quality machine-produced in the country. Other Providence woolen companies such as the Wanskuck Company began the production of worsteds in the 1870s.

Incorporation and Expansion in the Base-Metal Industries

Steam-engine manufacturers especially benefited from the Civil War. The Providence Steam-Engine Company obtained a contract to produce engines for Union sloops of war. To meet the government's demand for marine steam-engines and manufacturers' demands for stationary steam-engines, the Providence Steam-Engine Company incorporated to gain enough capital for expansion. The Corliss Steam-Engine Company (incorporated in 1856) also expanded to meet wartime production needs.

In the ten years before the war, sewing-machine production had grown so rapidly in the United States that the value of sewing-machines manufactured nearly equaled the value of all textile machinery produced. While the private demand continued, the war expanded the market for industrial machines to be used in the mass production of clothing, boots, and shoes. Brown & Sharpe continued to expand during and after the war as manufacturers of sewing machines, as well as manufacturers of tools in demand by other sewing-machine companies and by machine manufacturers in need of precision tools. In order to take full advantage of the expanding market for its goods, the company incorporated in 1868 and began construction of a new factory at Promenade Street in 1870.

Gas Lighting and Production

One of the major factors affecting industrial expansion was gas illumination. With it the manufacturer could run his plants for longer hours with less risk of fire and at a lower cost than oil lighting.

Thus the Providence Gas Company, which, by 1872, had a monopoly on municipal production, was one of the city's most important companies. As a result of the growing industrial and private demand for gas lighting, the Providence Gas Company began construction of a large, new, coal-production plant on Globe Street in 1870 and continued to build gasometers in various parts of the city. While most companies patronized the Providence Gas Company, the city's largest textile company—the Atlantic Delaine Company (Manton Avenue)—formed its own coal-gas company.

The Streetcar Network

Another development affecting industrial growth was the construction of the street railways. The system of horsecar lines loosened the bonds which had geographically tied workers to places of employment and allowed the construction of both factories and residential neighborhoods on vacant land away from the dense center of the city by providing connections to the banks, offices, and city markets of downtown.

The first horsecar line ran from Providence to Pawtucket in 1864. In 1865, the Union Railroad was incorporated with large holdings owned by the Sprague family. Its first line ran from Olneyville to Market Square and soon afterwards the company built tracks along the major highways of Providence. In 1872, the Union Railroad Company, having bought the Providence-Pawtucket line, gained a monopoly on horsecar transportation in and around Providence.

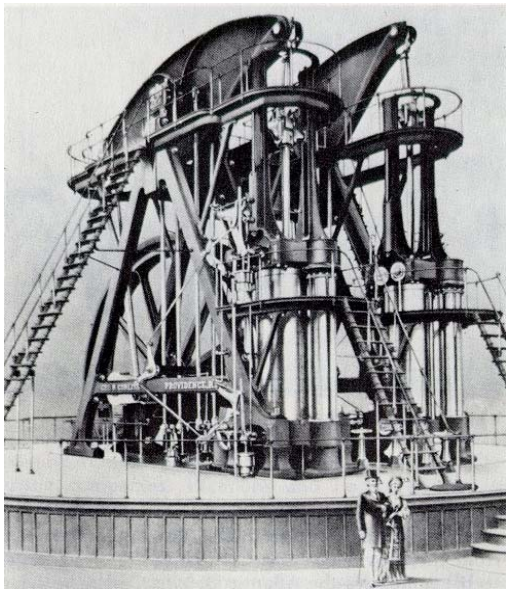

Fig. 21: The Centennial Engine (1876). Built by George Corliss Steam Engine Company. This massive engine provided power for Machinery Hall at the Centennial Exposition in Philadelphia. Courtesy of the Rhode Island Historical Society: RHi X3 2858.

The Panic of 1873

The Panic of 1873 proved more devastating than any previous economic depression because of the extent and rate of expansion that had occurred during and after the Civil War. The result of over expansion by the railroads, inflated greenback currency, an overabundance of farm products (causing a sharp drop in prices and a corresponding decrease in spending by the rural sector) was the failure of two vital New York brokerage houses which, in turn, precipitated the panic.

The major Rhode Island concern to fail was the A. & W. Sprague Manufacturing Company. Besides owning the Providence streetcar system and numerous manufacturing and printing plants in the Pawtuxet Valley, the Sprague family had investments in mills and mill sites extending from Maine to Georgia. The Spragues also had investments in Western land as well as in several diversified industries scattered throughout various states. When A. & W. Sprague declared bankruptcy, many Providence savings banks which held Sprague notes were forced to reorganize; two failed at a loss to depositors. A few Providence manufacturing companies, including the Atlantic Delaine Company, failed as a direct result of the panic–and most were affected by the depression. During the next six years mill shutdowns, short workdays, and layoffs were common,

INDUSTRIAL MATURATION: 1873-1900

If the first three quarters of the nineteenth century was a period of industrial expansion, the last quarter of the century was a period of consolidation. Industrial growth did not end with the Panic of 1873; the formation of new industries and expansion of the labor force through immigration continued through the nineteenth century and into the twentieth, but the unbridled growth of industry and the drastic extremes of the business cycle gave rise to marketplace adjustments to meet or avoid increasingly complex obstacles to continued economic growth. Having fully committed themselves to a heavily industrialized economy, Providence civic leaders and businessmen began to seek measures to ensure its continuity. These early attempts included diversification into new industries, participation in international expositions (especially the Centennial Exposition of 1876), consolidation of industries, and civic improvements such as the construction of water-supply and sewage systems, as well as improvement to Providence Harbor. Another step taken by manufacturers as a response to business crises was cut labor costs by reducing wages, which alienated the work force and triggered the labor movement of 1880s organized by the Knights of Labor. These products of the maturation process had a profound effect the development of Providence's economy in the twentieth century.

Population Growth and Immigration

The population of Providence grew from 50,000, 1860 to 105,000 in 1880. This enormous rate of growth was due both to the re-annexation of parts of Cranston and North Providence and to a steady influx of immigrants from Ireland, Germany, Scotland, Portugal, and Sweden. After 1880, natives of these countries continued to form part of the immigrant population of Providence, but Italians and Eastern European Jews (their fleeing poverty and persecution) formed the largest proportion of new immigrants. They found work largely in the city's textile mills and jewelry factories, which employed proportionately more unskilled laborers. Skilled immigrant workers had a wider range of employers.

Expansion of the Worsted Industry

The worsted industry recovered from the depression of the 1870s and prospered during the 1880s and 1890s. By

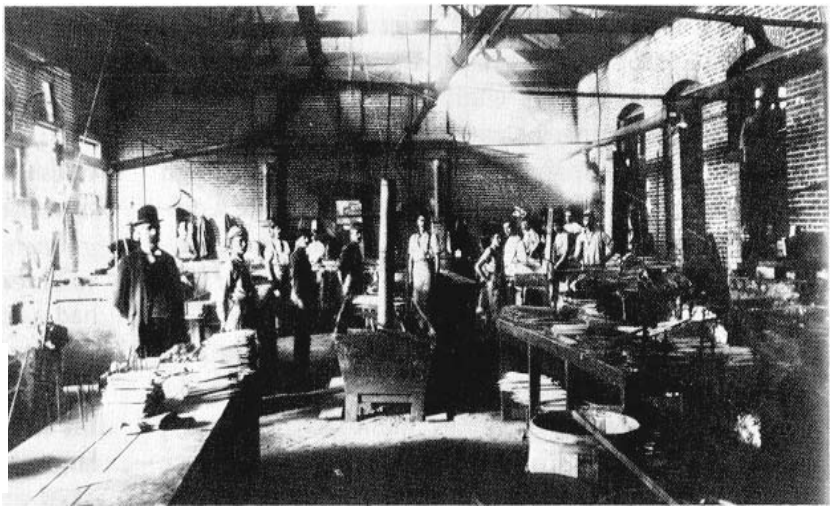

Fig. 22: Workers at the Nicholson File Company; Acorn Street; photography, c.1815. The Nicholson File Company, one of the country's most important base-metal companies, was a major Providence employer. Courtesy of the Rhode Island Historical Society: RHi X3 1494.

1890, Providence produced more worsted goods than any other American city. The city's worsted companies, with a total of 8,887 workers by 1900, were vital to Providence's economic growth.

The industry prospered because of the popularity of worsted cloth, protective tariffs, the expanded labor force, and improved machinery. Manufacturers had replaced hand combs and other less sophisticated automatic combs with the Noble comb by 1870. After 1870 worsted manufacturers took advantage of continual improvements made in spinning and weaving machinery, among which was the Crompton and Knowles Worsted Loom. This loom could operate at a much faster speed and was built to take particular advantage of worsted yarn's strength. The worsted loom shortened production time thus providing an advantage over woolen manufacturing.

Expansion ultimately depended on a large market for worsted goods. The Paris Exposition of 1867 promoted the fashion of worsted suits and coats in Europe; similarly displays at the 1876 Centennial Exposition stimulated the worsted suit and coat market in America. By the turn of the century, worsted men's suits had nearly replaced woolen suits.

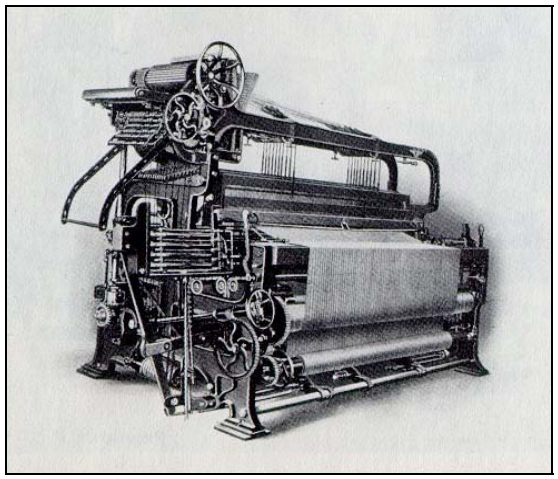

Fig. 23: Crompton and Knowles Worsted Loom; catalog, 1919.

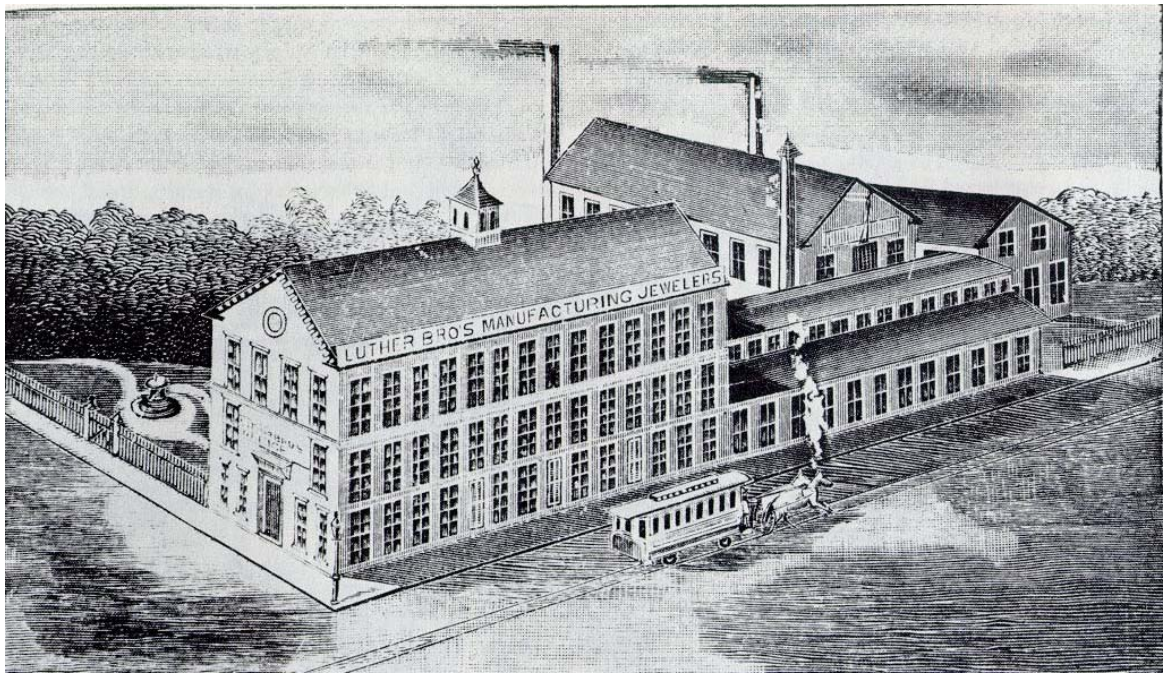

Fig. 24: Luther Brothers Factory (1865 and later); Oxford Street; engraving, 1887. This company was an innovative leader in production equipment and jewelry boxes. Courtesy of the Rhode Island Historical Society: RHi X3 2846.

The Jewelry Industry

The jewelry industry had grown sporadically until 1865 because the Panic of 1857 and the Civil War had caused major setbacks. The Panic of 1873, however, seems to have had little effect on the postwar boom in jewelry manufacturing. While in 1865 there were 45 shops employing over 700 workers (half as many as were employed in 1856), by 1875 there were over 130 companies employing almost 2,700 workers. By 1890, Providence had more than 200 firms with almost 7,000 workers. The expanding market for inexpensive jewelry, the growing labor force, and the process of mechanization were responsible for this growth. Unlike the base-metal or textile industries, however, the industry did not attract large investments because of its volatility. Since jewelry was a luxury item, success or failure depended largely on timing and marketing, while in the base-metal or textile industries success was more closely tied to the cost and quality of the product. Consequently each manufacturer mechanized within his company and rarely sought patents for his machinery. Without patent protection manufacturers could not prevent other companies from imitating machinery (which was generally much less complex than textile machinery), thus accelerating the process of mechanization.

Several Providence companies were responsible for important technological advances in the jewelry industry. Most notably Levi Burdon's seamless-filled-wire production (109-111 Summer Street) stimulated the chain-making industry, and the Luther Brothers (212-216 Oxford Street) stud-wire machine and electroplating process stimulated the production of plated novelty items and shirt studs. The manufacture of novelties (buttons, studs, emblems, and badges) and of traditional pins, earrings, and necklaces aided the development of the findings industry which provided pinbackings, necklace catches, and other components used in the industry.

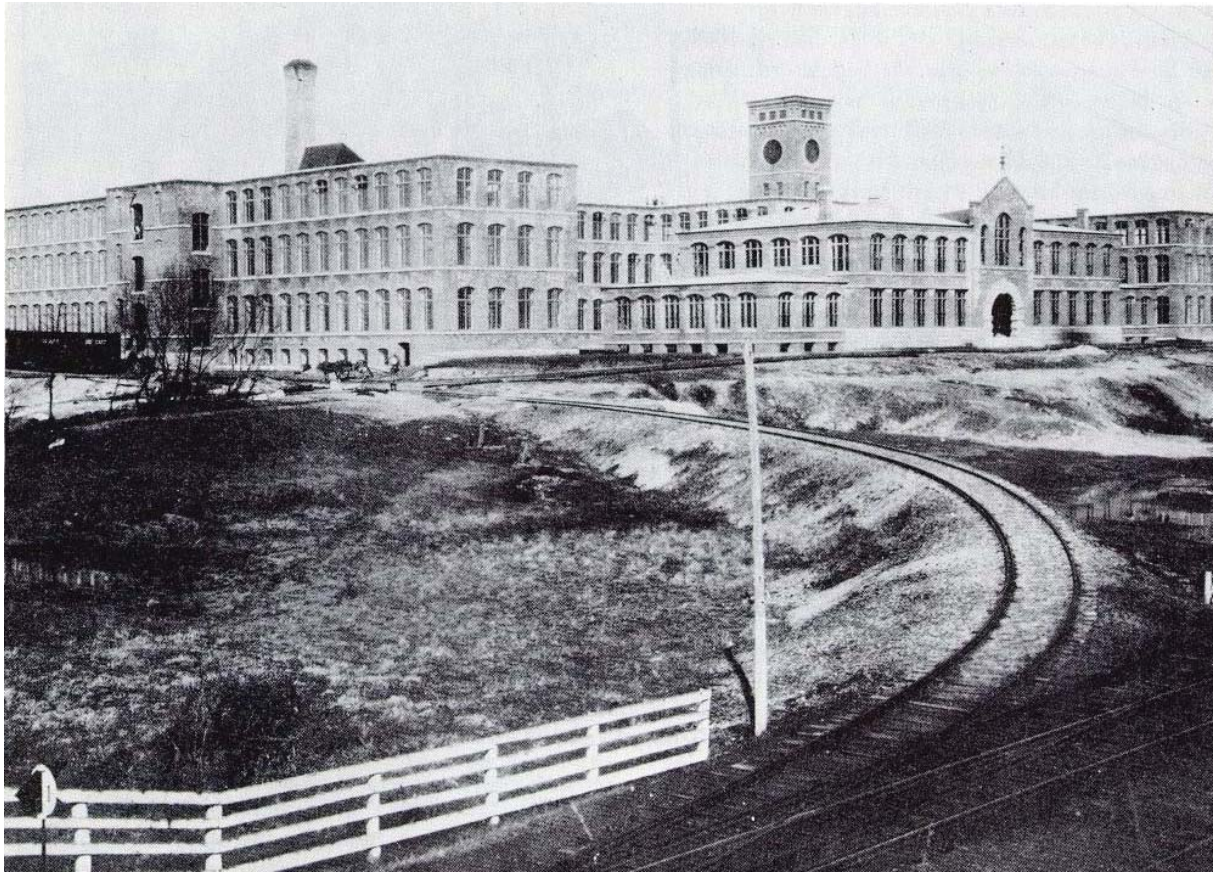

Fig. 25: Gorham Factory (1880) Adelaide Avenue. This large new factory replaced its crowed Steeple Street quarters. Courtesy of the Rhode Island Historical Society: RHi X3 2978.

The growing importance of the industry was emphasized by the development of a jewelry district. The increase in both the size and the number of companies caused overcrowding in the former district along North Main Street which had been composed of numerous small shops. The late nineteenth-century jewelry district bounded by Pine, Chestnut, Clifford, and Eddy Streets was characterized by multi-storied brick factories housing numerous companies. Renting a shop in these large factory buildings proved beneficial to small or moderately sized companies; for larger companies the construction of a factory was an excellent investment. Of the numerous manufacturing buildings constructed in the jewelry district in the late nineteenth 18 century, only the Champlin-Hedison Building (116 Richmond Street), the Remington Building (91 Friendship Street), and the Jesse Metcalf Building (158 Pine Street) survive.

While prominent in the jewelry industry, Providence was also the leading American city in the production of silverware by the turn of the century. The Gorham Manufacturing Company, at the forefront of the industry, built a large factory at Adelaide Avenue in 1890. This construction stimulated the residential and industrial development of the Mashpaug Pond section of Elmwood.

New Industries

Several new companies demonstrated large-scale attempts at industrial diversification. The Davol Rubber Company (69 Point Street) formed in 1874 by Joseph Davol was the first American company to manufacture rubber drug-and-surgical supplies—the American rubber industry previously having been dominated by the manufacture of rubber boots and shoes. Likewise the Vesta Knitting Mills (Bassett Street at Imperial Place) was one of the first American manufacturers to produce knitted goods made on a circular-knitting machine. The knitting industry, begun with the invention of a power-knitting machine (1867), was dominated by companies which made unshaped knitted goods and sewed them together to make garments. Both of these companies were of national importance by the turn of the century. The Oakdale Manufacturing Company (160 South Water Street), a large margarine manufacturer, and the Providence Steam and Gas Pipe Company (later the General Fire Extinguisher Company, 260 West Exchange Street), manufacturers of the Grinnel Automatic Sprinkler System (an advanced fire prevention system), also became nationally known for their innovative products.

Fig. 26: Vesta Knitting Mills; illustration, 1907. Vesta was one of the first American companies to manufacture knitted goods made on circular-knitting machines.

Utilities and Transportation

Probably the most far-reaching technological advance of the late nineteenth century was the introduction of electricity. Replacing gas for lighting, steam for power (especially in jewelry factories), and horses for trolley transport, electricity had an effect on virtually all aspects of industry.

The Rhode Island Electric Lighting Company (1882) and the Narragansett Electric Lighting Company (1884) were Providence's first electric companies. In 1888 the Narragansett Electric Lighting Company, under the leadership of Providence banker Marsden Perry, bought the Rhode Island Electric Lighting Company, thus forming a monopoly on commercial electric-power production. The company built its first major plant (Eddy Street at South Street) in 1889.

The reasonable price of gas and existing power systems, particularly in textile mills, precluded immediate universal adoption of electric power, but electric motors solved the problem of excess power production which was a major drawback of steam power, especially for small jewelry and base-metal companies. Furthermore, electric lighting provided superior illumination and decreased fire hazards.

Electric trolley cars, which were a fast and cheap mode of transportation, were adopted by many cities as early as 1888. In 1893, Perry, who had obtained a twenty-five-year monopoly franchise on the trolley system as well as financial backing arranged by Senator Nelson Aldrich, bought all of the Providence and Pawtucket franchises and began the electrification of the system which was completed by 1895. Power was provided by the Rhode Island Company power station, also owned by Perry.

While Perry's monopoly resulted in quicker electrification of the system than might have been accomplished under city ownership or by a smaller company, there was much dissatisfaction expressed both by the employees and the passengers with the way Perry managed the lines. It was not surprising, therefore, that when the motormen, demanding shorter hours and protesting wage cuts, went on strike in 1902, they were supported by the public.

In 1906 Perry sold the trolley system to the New Haven Railroad, giving it a monopoly on transportation in Rhode Island. The monopoly antagonized manufacturers, brokers, and the general public with high prices as well as poor service, and many expressed concern for its short- and long-term, adverse effect on the city's economic growth.

Fig. 27: Interior, Narragansett Electric Lighting Co. office (1897); 60 Weybosset Street. Courtesy of the Rhode Island Historical Society: RHi X3 2165.

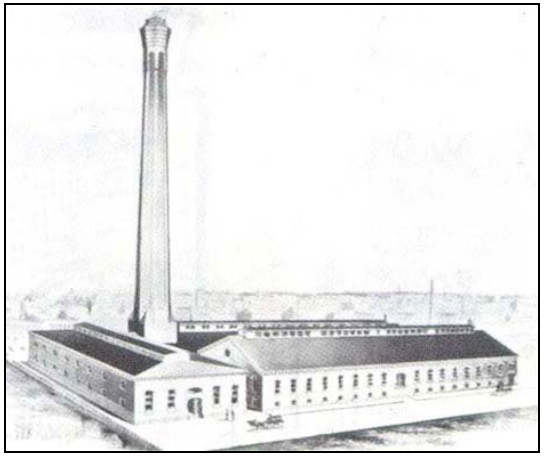

Fig. 28: Narragansett Electric Lighting Company power station (1889): replaced in 1913); Eddy and South Streets. Courtesy of the Rhode Island Historical Society: RHi X3 2845.

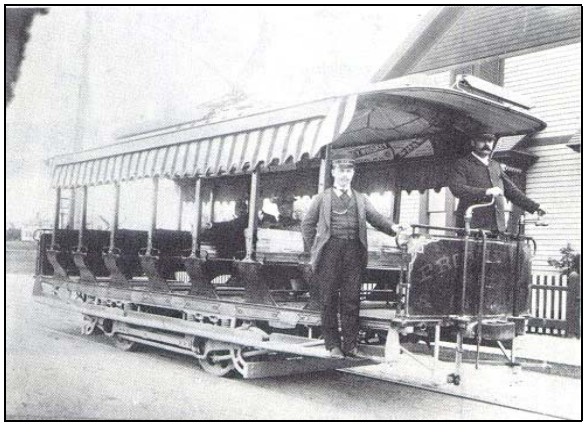

Fig. 29: Electric trolley car, Providence & Cranston line; photograph c. 1895.